Recreate Eratosthenes' Experiment

Description: If you will be traveling 150miles or more due north or south this semester, you can attempt to recreate Eratosthenes' experiment measuring the size of the Earth by finding the altitude of the North Star from each location. You will use your data to calculate the circumference of the earth and the error in your measurement.

Caution: Phoenix is not far enough away and San Diego and LA are not far enough North/South! This is a good option only if you are traveling somewhere north of about Flagstaff (East/West doesn't matter so anywhere in the US North of Flagstaff) or south of Hermosillo in Mexico.

Materials needed: Astrolabe, calculator

Resources:
Google Maps

Instructions:

(1) If you are going to be traveling 150 miles or more due north or south this semester (the farther the better), you can measure the size of the Earth. The two observations should be done at about the same time of night within about a week or two of each other. (This is because Polaris really does move a small amount over the course of a night).

(2) On a clear night at each location, hold your astrolabe vertically and sight Polaris (the North Star) **through** the straw. Now, *without moving the astrolabe*, pinch the string that dangles from it so that it won't move when you do. Hold the string in place until you've marked it's location with a pencil. You will be able to read the angle of elevation of the north star off of your astrolabe using this mark. Record the date, time and location of your observation as well as the altitude that you found for the north star.

(3) At home, find the north-south distance between your two observing locations, which can be measured using a map. ***Note that unless you didn't travel East/West at all you cannot simply draw a line connecting the two cities and find its length. You need the North/South distance ONLY. It may help to draw a horizontal line through each of your cities across your map and then measure the straight up and down distance between the two horizontal lines.*

Data:

(1) Table showing the date, time and location of each observation as well as the altitude you found for the north star.

Questions to Address in Your Poster's Data Analysis Section:

(1) Step-by-step calculation of the Earth's circumference according to your measurements. The basic procedure here is to use ratios. The ratio of the **change in** the north star's altitude between your two observing locations (in degrees) to the distance around a whole circle (in degrees) is equal to the ratio of the N/S distance between those two points (in miles, or another unit of distance) to the circumference of the Earth (in that same distance unit). Since the whole point of this lab is to measure how accurately you can estimate the circumference of the Earth with simple measurements, this is the "unknown" that you should solve for in your equation.

(2) Look up the true circumference of the Earth and then calculate the error in your measurement. Show your calculation. Did you do better or worse than Eratosthenes did 2000+ years ago?

(3) What are the possible sources of error in your experiment? How could your experimental method be improved to calculate the circumference of the earth more accurately?